Agent Modeling

MURI Program Briefing
Washington, DC
August 09, 2007

Jentsch, F. (2007). Agent Modeling. *Presentation to the Office of Naval Research Collaboration and Knowledge Interoperability Program,* Arlington, VA, August 9th, 2007.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2007	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Agent Modeling	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of Central Florida**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**20**	

NAPS

Sometime its just better to sleep through it all

Agent Modeling Team

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- Primary Scientists:
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Human Factors and Aeronautical Engineering

Overview

- Roles of Agents in Teams
- Research Issues:
  - Primary Research
  - Enabling Objectives and Technologies
- Approach:
  - Practical Problems
  - Tasks & Linkages
- Year 1:
  - Mapping the Roles of Intelligent Agents against the CKI Framework

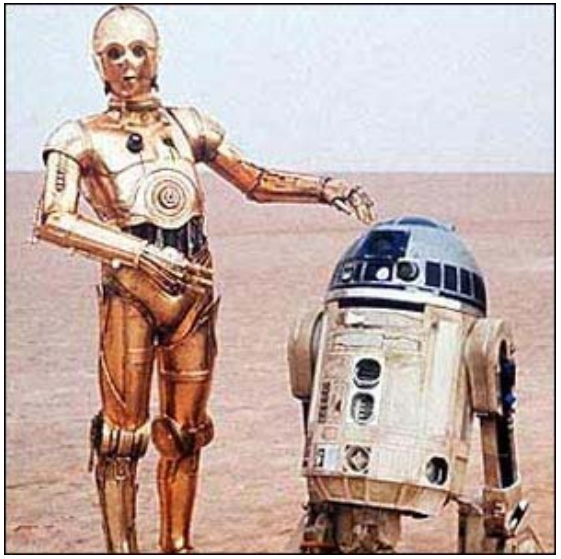
Agent Modeling: Background & Motivation

- Desired Outcomes
  - Develop models & techniques for facilitating interactions for human-agent teams
    - Control of agent teams
    - Many-human/many agent teams
  - Develop models & techniques for emulating human performance
    - From literature
    - From archival data
    - Online adaptation to emulate human teammates

One-Of-A-Kind Teams In One-Of-A-Kind Situations

Roles of Agents in Teams

- Agents can act in teams as:
  - Taskwork-functional components:
    - Collecting/storing/processing/retrieval of task data
    - Representation of task data
  - Teamwork-functional components:
    - Process assessment
    - Dynamic function allocation
    - Team "metacognition" and coaching
  - Surrogate team members:
    - Training
    - Research
  - External observers:
    - Data collection for research and training



Research Issues

- Primary questions, in order of precedence:
  - Agents as teamwork-functional components
  - Agents as external observers
  - Agents as surrogate team members
- 6.1 nature of the work:
  - Study wide range of potential variables to model
  - As generalizable across task areas, team sizes, team structures as possible
- Enabling objectives and technologies:
  - Identify and collect critical data
  - Select simulation environment and methods
  - Match computational load to capabilities

Approach: Practical Problems

- Constraints to "Realism":
  - Open-ended vs. scripted scenarios
  - Complexity of team member signatures
  - Embodied agents
  - Communication modes
  - Behavioral outputs
  - Modeling environment
  - "One-of-a-kind" situations

Approach: Tasks & Linkages

- Collect data to model
  - Theory, metrics, experimentation
- Analyze modeling data
  - Metrics
- Create initial teammate emulation
  - Theory
- Cross-validate model against archival data
  - Metrics
- Conduct single and "double" Turing test & identify human/agent differences

Year 1: Mapping the Roles of Intelligent Agents against the CKI Framework

Agents in Macrocognition

- Externalized cognition allows agents to become *first class* participants by doing things such as:
  - Identifying targets
  - Filtering information
  - Communicating messages
  - … just like human participants
- Difficulties exist for processes such as problem conceptualization or sense making that require nonstationarity

Agents in Knowledge Building

- ✓ Pattern recognition
  - ✓ ATR and other sensor-driven recognition
  - ✓ Situation classification; example: machine learning for rating credit worthiness
- ? Mental model construction
  - ✓ Yes, if involves match to stored models
  - × No (or extremely difficult) if requires discovery/reorganization

Agents in Team Knowledge Building

- ✓ Knowledge sharing involving deictic pointing
  - ✓ Spatial/geographic references on shared map or screen
  - ✓ Sequence or temporal ordering through timeline
- ? Knowledge sharing requiring NLP
  - ✓ Key words to index stored plans/contexts
  - × "Understand" team dialog & discussions

Agents in Sharing Unique Knowledge

- ✓ Eliciting knowledge from teammates
  - ✓ Queries for empty slots
- ☐ Communicating own knowledge
  - Text/speech tend to be too explicit/extensive
  - Graphical expression such as marked-up map deliver information in parallel
- ✓ Identify things to point out/share (recognize expertise)
  - ✓ Overlay models to id potentially missing information from group decisions (critiquing)

Agents in Shared Conceptualization

- ✓ Visualization of data
  - ✓ Automated choice & generation of visual representation (such as SAGE or APT)
- ? Team problem model/common ground
  - × Difficult for agent unless team shares its model
  - ✓ Graphical/map based model could be shared

Agents in Consensus Development

- Can agents vote? Do we want them to negotiate?
- ✓ Option generation
  - ✓ Agent with HTN planner could propose & or critique plans if expressed in accessible form
- × Intuitive decisions, critical thinking
- ? Storyboarding
  - ✓ Maybe if using agent generated or accessible graphics

Agents in Outcome Appraisal

- ✓ Maintain performance logs and other records of problem solving episode for AAR
- ✓ Workspace awareness, activity awareness, etc.

Summary: The Way Ahead

- Integrating agents into a macrocognitive process requires a common (external) representation they can access
- Agent-generated or -accessible graphical displays of maps, timelines, etc. seem the most natural way to achieve this
- The Macro-Cog discrete event simulation appears to allow sufficient access to state variables for agents to be situation aware

RELAXATION

Take time to smell the flowers.
Then eat them.
Then puke them up on the carpet.